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ABSTRACT

Presented is the product of a curriculum project originated in the Mequon-Theinsville Sex Equity Committee, and focusing on mathematics anxiety and avoidance. The project's two major purposes were to: (1) have the district's mathematics instructors become aware of the problem, its implications, consequences, and suggested intervention strategies; and (2) initiate the development of some concrete curriculum activities at the high school level, aimed at increasing pupil participation in mathematics. Sections in the report include: (1) a summary of research on math anxiety, including categorized recommendations for overcoming the problem; (2) statistics from Homestead High School's second semester in the 1979-80 school year; (3) reference materials related to mathematics anxiety available in the district's curriculum library; (4) a list of mathematics centers and resource people contacted by the project; (5) sample student activities aimed at career education, with problems geared to particular careers and career profiles; (6) a description of a videotape series developed to provide accurate information about women and mathematics; and (7) a selected bibliography. (MP)

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Math Anxiety, Math Avoidance, Participation in Math:

A summary of research curriculum recommendations for career education

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Career Incentive Act Project for the Sex Equity Committee
July, 1980

SE 033 187

"Mathematics is more than just a school subject. It is a national resource, a national concern, and, at times, a national issue."

National Advisory Committee on
Mathematical Education

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I. Preface

This curriculum project originated in the Mequon-Thiensville Sex Equity Committee. The subject of Math anxiety and Math avoidance is of current interest and study by psychologists, counselors and math educators. The original impetus for many of the research projects was the traditional differences in math achievement and participation of males over females and the vast discrepancy in the number of males and females in the scientific and technological career fields. Because of this math anxiety has often been identified as a female issue. However, research has provided insight into many areas of mathematics learning, teaching methods, career education and methods of handling math anxiety which can be applied to many people at many levels.

The purpose of this project is twofold. The first is to have district math teachers become aware of the problem of math anxiety, its implications and consequences and some suggested intervention strategies. The second is the development of some concrete curriculum activities at the high school level aimed at increasing participation in Mathematics.

II. Summary of Research

A. Math Anxiety: What and Why

Math anxiety has been described as both "an intense emotional reaction to any quantitative task"[1] and as "a non-rational distaste for and avoidance of math and math-related subjects"[2]. These math anxious feelings often seem to develop in the junior and senior high school years and can cause people to make career decisions that have long-range effects. Mathematics has been identified as a "critical filter"[3] for employment. A poor math background can exclude people from many entry-level opportunities as well as hinder promotions in mid-career. If, as educators, we are interested in career education, we must become aware of and act upon this problem.

Several reasons have been proposed for this aversion to mathematics. Most people feel comfortable with math only up to a certain point or topic. They then have a "sudden death"[4] experience after which the students are sure they can do no more math. Many feel that they do not have a "mathematical mind"; they do not trust their intuition. Others feel math is too authoritative with its myriad of rules and formulas and that it is too concerned with detail and symbols. The lack of relevance of math courses to real life is often cited as cause for math avoidance. Math is often labeled as being boring, tedious and the province of geniuses. And one last reason for math anxiety is the social acceptability of mathaphobia. How many times, on hearing that you are a math teacher, have you heard people react by saying: "Math was my worst subject in school" or "I'm lucky if I can balance by checkbook"?

There seem to be other reasons for avoiding math which are particular to females and are usually the product of socialization and sex-stereotyping. Math has traditionally been viewed as a "male domain" and, therefore, is rejected by women. Females often are made to feel innately inferior to men and fear a loss of femininity if they succeed in math. The existence of math avoidance among women is manifested in a few statistics. "women make up 2% of all physicists, 5% of all chemists, .1% of all engineers"[5] and 10% of mathematics doctoral candidates. In 1973, Lucy Sells found that 57% of the males and 8% of the females entering Berkeley had 4 years of high school math, making 92% of the women ineligible for the calculus sequence and for all but 5 out of 20 majors.[6]

There are other reasons, along with math anxiety, which have been traditional ways of explaining the discrepancy in math achievement and participation. Each will be briefly described and related to math anxiety with possible intervention strategies discussed.

B. Sex differences in math achievement

Until about age 9, boys and girls achieve about equally well in all subjects, with girls doing somewhat better in computational skills. By age 17, boys excel in all areas except creative writing and music. The ability to do well in math, beyond computation, seems to be partially related to one's ability with spatial relations, one area in which boys have excelled at all ages. Spatial relations ability is thought to be a valuable skill for problem solving, another area in which high school age males test higher than females. Research has indicated some explanation for this phenomenon. Girls may have trouble with problem-solving because they are generally more conforming and dependent on the opinions of others. They may not be as

apt to take risks and think for themselves. As girls enter puberty, they are exposed to more intense sex-role socialization and are pressured not to excel in non-traditional sex roles. Math becomes harder and demands more commitment. Girls, therefore, have "good" reasons to avoid math.[7]

Another point well taken is that not all math is learned in the classroom. One explanation for boys' achievement in spatial relations is that they are often involved in manipulative activities, i.e. taking things apart, putting them together, hand-eye calculations and time, speed and distance judgments from sports activities. One last point concerning differences in math achievement could be the fact that, until recently, students were tested with the same test at the same age with differing amounts of math background. It is important to keep in mind that recent research indicates that differences in math achievement are not due to ability but rather to role expectations and social pressures.

C. Sex-role stereotyping

Math has traditionally been thought of as a "male domain" and this causes conflicts for girls who are interested in or excel in math. Sex-role stereotyping research indicates that many females regard careers as incompatible with family responsibilities. Some research shows that girls feel a conflict between raising a family or their husband's career and their study of math. Many girls seem to choose areas of study on the basis of what they think men will tolerate. If girls perceived a greater usefulness for math in their future, they might be more likely to continue their study. Also if they are aware of the fact that about 95% of all people work at least 25 years of their life, they might also choose their careers more carefully.

D. Differing attitudes toward math

A student's attitude toward math has been shown to be an important predictor of math achievement. Attitude has been shown to be directly related to actual and aspired grades in math. A student's math experience in late elementary and early junior high school seem to be very important in shaping one's attitude toward math in the future.[8]

Girls and boys show a different attitude toward math. A main reason seems to be the student's perceived need and usefulness of math. Research indicates that boys do not like math any more than girls but that they do feel a strong need for math in the future. Girls see math as "men's work" and not necessary for the future. Another situation which seems quite common is the manner in which success and failure in math are explained. If boys do poorly, it is because of a lack of effort. If girls do poorly it is because of a lack of ability; when a female succeeds it is due to luck.

E. Parental Influence

Parental influence on math achievement has been studied and yields some interesting results. There is evidence that support and encouragement from parents is crucial for girls in deciding on math courses. In fact, the influence of the father may be more important than that of the mother for several reasons. About 75% of the mothers whose daughters do poorly in math accept this because of their own lack of ability or self-confidence in math. On the other hand, liking for math is often related to the father's liking for math in the case of boys and especially of girls. There are

probably "as many mothers who need to gain self-assurance in math as there are fathers who need to realize that their daughters need encouragement."[9]

Parental expectations are considered one of the most important socio-cultural factors of math achievement. Low parental expectations of math ability is a deterrent to advanced high school classes and to math performance in general. Higher parental expectations give a student a more positive self-concept in math ability and, thus, a student is more likely to take more math. Again, parental expectations seem to have a greater impact on a girl's self-image than on a boy's.

F. Career relevance of mathematics

Course choices and achievement in math seem to be heavily reliant on the perceived usefulness and need for math in the future. Girls traditionally have been less oriented to careers outside the home. And even those choosing a career stayed out of the math and science fields. Some reasons for these choices are the feeling that a career interferes with marriage and family and a lack of appropriate role models for girls. Boys and girls both are unaware of the relevance of math to certain career areas, causing some math avoidance. Again we hear the call for math applied to real life situations as means of handling math anxiety. One last interesting perspective of career relevance is cleverly noted as $\frac{\text{"CD}}{\text{HD}} = 1$"(career development over human development equals one whole being.)[10]

G. Influence of significant others

The "significant others" referred to include teachers, counselors and peers. Research on their influence show variance, but there are a few observations which are worthwhile. A teacher's support or lack of support seems to affect achievement in math in two ways. A bad experience with a teacher can often lead to negative attitudes. However, an inspirational teacher can often play a major role in career choices. To be a successful teacher in this aspect one should be "competent in math, show enthusiasm for the subject and have faith in the capacity of students to master skills."[11]

Teachers also seem to be the carriers of society's role expectations. Teachers should be aware of any differential treatment of boys and girls. They should realize the importance of actively recruiting girls and of expecting the same performance from both sexes.

Counselors are often consulted more frequently by girls. Regarding math choices girls often get no encouragement or even negative feelings. It is important, therefore, for counselors to become more aware of their own feelings and to learn to keep their own math anxieties from influencing a student's choice.

The influence of peers is very important, as can be expected. Unfortunately, the attitudes of peers often reinforce existing stereotypes. Peer pressure against girls taking math seems to come more strongly from boys. Students in high school generally view math as a male-dominant subject. Advanced math courses are, more often than not, taught by men. Achievement and course choices are often influenced by the sex ratio of the particular class. A four-year math requirement for all is one suggestion which would not require girls to defend their couse choices.[12]

H. Recommendations for overcoming achievement differences and math anxiety.

These recommendations are many and varied. They fall into three main categories; 1) develop a positive attitude toward math; 2) develop a perceived need for math in future career choices; 3) awareness of the influence of significant others.[13] The most efficient form of presentation is a listing of recommendations with sources noted.

*Stanley Kogelman - Mind over Math[14]

1. Have students write math autobiographies describing own math history and feelings toward math;
2. minimize pressures of time
3. encourage use of intuition and educated guessing;
4. seek out and give individual recognition for alternative problem solving methods.

*Lynn Fox - Four Goals for Education[15]

1. greater awareness of value and usefulness of math competency for adult life;
2. reduction of harmful stereotyping of math as "male domain" and feminine roles as incompatible with achievement and competency in math;
3. foster greater awareness and sensitivity on the part of parents, educators, and the public in promoting the full development of all talent areas of young children;
4. promotion of flexible and democratic education system that deals with individuals not stereotypes.

*Edith Luchins - recommendations for encouraging math careers[16]

1. change the attitude that math is unfeminine;
2. teachers and counselors should become more aware of math career opportunities
3. more female role models;
4. equal treatment of male and females, including exposure to non-traditional career roles;
5. greater emphasis on math; advise three to four years in high school.

*Milwaukee Public Schools-Abstract for Math Anxiety/Avoidance Prevention Program[17]

1. provide remedial courses;
2. provide counseling to learn to cope with anxiety;
3. increase career education;
4. provide peer tutoring to allow for a less threatening atmosphere and more positive role models;
5. staff inservice on math anxiety and teaching techniques.

An excellent description of math anxiety with some very perceptive teaching suggestions can be found in Sheila Tobias' book Overcoming Math Anxiety. This is highly recommended for all math teachers and even for teachers of other subjects.

I have chosen several recommendations on which to base my curriculum project - career awareness, perceived usefulness of math in future careers, math problems with relevance and strengthening female role models. The activities are found in Section VI.

I would like to end the way I began with a quote. "From a feminist perspective, mathematical literacy is a way to demystify the world."[18] I think it is appropriate to expand this to a human perspective.

III. Enrollment in Mathematics classes at Homestead High School, Semester II, 1980

Table I - Percentage of boys and girls by grade level

	Boys (%)	Girls (%)
Freshman	53%	47%
Sophomores	51%	49%
Juniors	54%	46%
Seniors	58%	42%
Total	54%	46%

Table II - Percentage of boys and girls in particular math classes

	Boys %	Girls		Boys %	Girls
Everyday Math	81%	19%	Algebra	49%	51%
Foundations of Algebra	54%	46%	Applied Math	52%	48%
Algebra I	49%	51%	Enriched Algebra II	59%	41%
Concepts of Algebra	55%	45%	Career Math	65%	35%
Geometry	48%	52%	Analytic Geometry	61%	39%
Enriched Geometry	48%	52%	Math Seminar II	58%	42%
Applied Geometry	51%	49%	Calculus	59%	41%
Computer Programming I	59%	41%	Computer Programming II & III	91%	9%

Note: There is a certain amount of duplication in these figures which has not been accounted for. Some students are enrolled in more than one math course, i.e. Computers and another or Math Seminar and Analytics.

In general, Table I shows a relative balance in the enrollment of males and females at the freshman and sophomore levels. However, the junior and senior year enrollments show a slightly increasing gap in the number of males over the number of females. Recent research indicates that this gap has been decreasing. These statistics seem to follow this tendency.

Table II, however, shows some trends which seem to be rather traditional. Up to Applied Math (excluding Everyday Math), the number of males and females is again relatively balanced. However, beginning with Enriched Algebra II and continuing with Computer Programming and all senior level math courses, a wider variance between the number of males over the number of females is evident. These statistics seem to support the research, which indicates a drop in participation in upper level high school math by females. It also indicates a need for the awareness and utilization of some of the recommendations regarding math anxiety and avoidance. The math taught at the junior and senior levels has proved to be important, especially in the choice of college majors which eventually leads to career choices.

IV. Reference Material related to Math Anxiety available in curriculum library

1. Mathematics Anxiety Annotated Bibliography
   Milwaukee Public Schools, Division of Curriculum and Instruction, Department of Elementary and Secondary Education

2. Mathematics Anxiety Materials List
   Milwaukee Public Schools, Division of Curriculum and Instruction, Department of Elementary and Secondary Education

3. Programs for Math Anxious People
   Appendix II from Overcoming Math Anxiety by Sheila Tobias

4. Speakers and Resource People
   List compiled from conference, Denver, CO., June 21-22, 1979
   "The Mathematics Filter: A New Look at an Old Problem"

5. Test-specific stress inoculation statements
   (preparing, confronting, handling test anxiety)

6. Mathematics/Science Intervention strategies for female students in elementary and secondary schools

7. Why Study Mathematics? A list of items and sources that try to answer this question.

8. Math Anxiety Bill of Rights

9. The Math in High School....you'll need in college
   A brochure prepared by the Mathematical Association of America

10. Mathematics - a list of career options for a math major from the Career Development office of Mount Mary College

11. Recommendations for the preparation of high school students for college mathematics courses

12. Ordering of 36 mathematical competencies with respect to the percentage of hiring officials

13. General characteristics of the typical "turned-off" Algebra students; suggestions for working with math anxiety, a primer on how to study math.

14. A highly incomplete list of applications of algebra in other fields.

15. Algebra required to succeed in shop, farm math, chemistry; real life problems

16. Mathematics: It can multiply your career options

17. Careers in the Medical Industry

V. Math centers/Resource people contacted:

1. Education Commission of the States, 1860 Lincoln Street, Suite 700, Denver, CO 80295; ("Women in Mathematics")
2. Lawrence Hall of Science, University of California, Berkeley, CA 94720; Nancy Kreinberg, coordinator of Math and Science Education for Woman.
3. Wellesley College Department of Math, Wellesley, MA 02181, Dr. Alice Shafer, Math anxiety workshops
4. Wesleyan University, Math Clinic, 547 Science Tower, Middleton, CN 06457, Bonnie Donady, Jean Smith
5. Math Department, Deerfield Academy, Deerfield, MA 01342 (Math Anxiety Colloquium)
6. John Ernest, Math Department, University of California, Santa Barbara, CA 93106 ("Math and Sex")
7. National Institute of Education, 1200 19th St. N.W., Washington, D.C. 20208 c/o Judy Schoemaker, Education and Work Group, Stop 26
8. National Association of Independent Schools Task Force "Occasional papers", Mail Room, NAIS, 4 Liberty Square, Boston, MA. 02109
9. William Cromley, chairman, NAIS Task Force, Germantown Friends School, 31 West Coulter St., Philadelphia, PA 19144
10. Sandra Davis, Continuing Education for Women in Math Program, Marjorie Mathison program director, Math Anxiety Clinic, University of Minnesota, Minneapolis, MN 55455
11. Deborah Hughes-Hallett, Preceptor, Department of Math, Science Center 105, Harvard University, Cambridge, MA 02138
12. Margaret Johnson, Meramec Community College, 11333 Big Bend Blvd., St. Louis, MO 63122
13. Calvin T. Long, Chairman, Department of Math, Washington State University, Pullman, WA 99163
14. Barry Mitzman, The Math Learning Center, 325 13th St. N.E., Room 302, Salem, OR 97301
15. Drs. Joseph Warren and Stanley Kogelman, Mind Over Math, 370 Riverside Dr., New York, NY 10025
16. Dr. Mitchell Lazarus, Educational Development Center, 55 Chapel St., Newton, MA 02160
17. Dr. Lenore Blum, Joanne Koltnow, Math/Science Resource Center, Mills College, Oakland, CA 94613
18. Eileen L. Poiani, St. Peter's College, Jersey City, NJ 07306
19. National Business Education Association, 1906 Association Dr., Reston, VA 22091
20. Ruth Afflack, California State University of Long Beach, Department of Math, Long Beach, CA 90801
21. Persis Joan Herald, Math Center, 3311 Macomb St. N.W., Washington, D.C. 20008 (Math Teaching Handbook)

22. Elizabeth Fennema, 476 Teacher Education Building, 225 N. Mills, Madison, WI 53705

23. Karen Skuldt, Education Division, University of Wisconsin-Parkside, Kenosha, WI 53141

24. Pamela Katzman, Department of Math, Minneapolis Public Schools, 807 Broadway NE, Minneapolis, MN 55413

25. Ann Fitzgerald, Dean, Denison University, Granville, OH 43023

26. Mildred Kersch, Math Education, Nancy Cook, University of Washington, Seattle, WA 98105

27. Association for Women in Mathematics c/o Women's Research Center, 828 Washington St., Wellesley, MA 02181

28. "Overcoming Math Anxiety" Suite 203, 1302 18th St. N.W., Washington, D.C. 20036

VI. Student Activities

In line with some of the recommendations cited earlier, I have developed two main curriculum activities aimed at career education, increasing perceived usefulness of Math in careers and relevance of math to everyday life.

A. The first activity will be a continuous bulletin board display of various occupations and the math skills used in these careers. The careers will be keyed to the second activity. I also hope to eventually have one person listed with each career that students may contact personally to get more information. I will vary the occupations to include those requiring a high school diploma only, some technical school training, college-oriented and advanced study careers. All information for the bulletin board will come from the attached tables from Hal Saunders article "When are we ever gonna have to use this?" from The Mathematics Teacher, January, 1980.

B. The second activity is a set of bi-weekly worksheets which will include two items. One side will have problems which are keyed to particular careers as well as to basic mathematics skills. The second side will include career highlights with job descriptions and training for career areas as well as for particular careers. Find below a list of the basic skills to be included and the number of problems using these skills as well as the list of problems and career highlights. These are not in the format in which they will be presented to students. Each math teacher will be asked to distribute the work sheets and will be provided with a transparency containing solutions. As the year progresses, some revision of problems will probably occur. Also the second problem will become increasingly more advanced in order to keep the interest of the junior and senior students.

Topics to be included in problems and the number of problems using these skills:

1. whole number calculations (6)
2. decimals (10)
3. percent (5)
4. rounding (8)
5. estimation (1)
6. calculator (5)
7. fractions (2)
8. averaging (1)
9. quick computation (1)
10. English measure (5)
11. ratio/proportion (6)
12. statistical graphs (5)
13. formulas (4)
14. area/perimeter (2)
15. statistics (2)
16. basic geometry concepts (8)
17. negative numbers (1)
18. angle measurement (3)
19. metric measure (4)
20. linear equations (3)
21. volume (2)
22. square root
23. exponents
24. scientific notation

These are listed in the order of their frequency of use in careers, according to Hal Saunders in his previously cited article. Problems 1 through 16 below are also from this article.

1. Career related problems

1. Payroll supervisor - reimburse employee for travel. Odometer readings 19438.6 and 19467.2. At $.15 per mile, how much should be reimbursed.
2. Environmental analyst - if 150 ships carrying 130,000 cu. m of liquified gas each visit a terminal, estimate how many cu. m of gas will be deposited. Your estimate should be within 500,000 cu. m.

PAGES 10-A THROUGH 10-D (TABLE 1) REMOVED DUE TO
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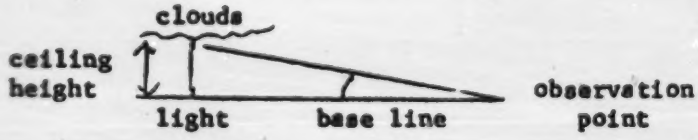
3. Pharmicist - child's dosage = $\frac{\text{child's age}}{\text{age} + 12}$ X adult dosage
   Find the dose of digoxin for a 7 year old if the adult dose is .25mg. Round to the nearest hundreth.
4. Farmer - if it takes 25 seconds to discharge 500cc from a sprayer, how long should it take to apply 120cc?
5. Nurse - a doctor orders 1/450 grains of a drug for a patient. The nurse has a vial labeled 1/300 grains per 2cc and a device that only measures in minims. If 1cc = 15 minims, how many minims does the nurse administer.
6. Geologist - must evaluate impact the construction on a 150 acre site would have on the infiltration of rain to the ground water supply. The geologist estimates that 5% of the rainfall normally infiltrates but none would, of course, if the site is developed. If the mean annual precipitation is 6 inches, find the annual loss of groundwater in acre-feet (an acre-foot of water is a one-foot depth of water covering one acre)
7. Auto mechanic - is buying taillight cover; for retail $12.50, wholesale $7.22. One dealer offers 35% discount off retail, another offers you a price of 25% markup over wholesale. Which is better and by how much?
8. Hospital dietician - hospital cooks measure food in grams but doctors sometimes order in ounces. If 4 oz. of meat are ordered, how many grams should be prepared?
9. Building supplies clerk - customer wishes to cover 30' x 20' area 2 inches deep with volcanic rock. If this rock weighs 1050 lbs/cu. yd., how many pounds does the customer need (to the nearest pound)?
10. Sheet metal worker - customer orders 31 gallon tank to fit in a rectangular area 14" x 18". To the nearest inch, how high should the tank be? (1 gal. fills 231 cu.in.)
11. Meteorologist - a weather balloon rises 8ft/sec. when the wind is blowing at 9.44 miles/hr. After 15 min. how far away (to nearest 100') from the launch point, in a direct line, is the balloon? Repeat the problem with metric units.
12. Hydrologist - Stream C - 12 cu. ft./sec.
    Stream A (4 cu.ft./sec.) and Stream B (8 cu.ft./sec.) feed Stream C. If dissolved oxygen in A is 4% and in B is 6%, will the fish in Stream C survive if they need 5.5% dissolved oxygen?
13. Landscape architect - has budget of $25,000 to construct 5,000ft. of curbing. Would like a maximum amount of rock curbing with the remainder to be asphalt diking. Rock curbing cost $6.25/ft. and asphalt diking is $4.30/ft. How much rock curbing can be laid?
14. Electronics engineer - resistance of a platinum wire temperature sensor $R_T = BT$ where B is a constant 3.66 ohms/^oK and T is absolute temperature in ^oK.
    Sensitivity of the circuit to changes in temperature $S_T = \frac{BR}{(R_1+R_T)^2}$
    Choose R, so that sensitivity at 70^oK isthree times as great as at 330^oK
15. Air Traffic Controller - important condition affecting pilots is ceiling height which is measured by a vertically focused light beam which is a known distance from the observation point. If base line is 800m, angle is 35^o, find the ceiling height to the nearest 100m.



16. Petroleum engineer - over time the pressure of oil in a reservoir will drop; the pressure-time relationship can always be defined in terms of the function $\triangle P = f(t) = A_1 t + A_2 + 2 + A_3 t^3$ where $\triangle P$ is change in pressure, t is time in years, and A_1, A_2, A_3 are constants pertaining to a particular reservoir

    Readings are taken at a particular reservoir

t(years)	$\triangle$P(psi)
3	456
6	632
9	692

    The initial pressure (in 1968) was 1778 psi. Solve for A_1, A_2 and A_3 and write out the pressure-time equation

    Problems 17-20 are from Career Mathematics - Industry and the Trades by Merwin Lyng et al.

17. - Photographer - needs to mount three 8½" x 11" pictures on stock that is 21-5/16" x 34-3/4" so they are centered up and down and equally spaced next to each other. Find margin around the edge and distance between pictures.
18. Secretary - types technical manuscript for 80¢/page. If she types 200 words per page, how much will she get paid for a 15,000 word manuscript.
19. Carpenter - installing a suspended ceiling in a room 9' x 27'. Ceiling tile sells for $.27 per 12" square. What is the cost of the ceiling?
20. Store manager - must complete a purchase order with the following headings:

Quantity	Item	Unit Cost	Discount	Net Cost

    Problems 21 through 26 are from Consumer Related Mathematics by Wallace W. Kravitz et al.

21. Accountant - reconcile expense account records determining balance due to company or to worker.
22. Family Budget - receipts for groceries for 3 weeks $65, $78, $75. What is the limit for the fourth week to keep the monthly average at $70 per week?
23. Family Budget - Given a monthly income and the percent to be spent on item, calculate dollar amount to be spent on items like food, clothing, housing.
24. Stock broker - line graph showing closing prices for a certain stock over a period of weeks. Questions related to the graph.
25. Homemaker - reconciling checkbook with bank reconciliation statement showing check amounts, deposits, service charges.
26. Family budget - making a large purchase and are given two prices - cash price and installment payment arrangements. Find the finance charges. If you can get a loan for 9½% which would be the better arrangement?

    Problems 27 through 32 are from Mathematics in Life by L. Care, Bolster and H. Douglas Woodburn.

27. Hospital Ward Clerk - receives pharmaceutical request form where he needs to compute the supply of medication needed.
28. Insurance actuary - given a table of mortality a series of questions using the table about probability.
29. Aerial photographer - can take pictures in such a way that can measure ground distance using similar triangles.

30. Railroad dispatcher - given a graph on a coordinate plan which shows schedule of trains. Questions regarding times and spurs.
31. Family-planning a vacation: using a map with distances given, find time needed to travel total distance of trip, cost for gas.
32. Fisherman - reading a tide table, converting to other city with tide correction table.

Problems 33 to 36 are from Skills for Everyday Living by David H. Weltsie

33. Consumer - enlarging a recipe
34. Consumer - buying a used car
35. Consumer - paying federal income tax
36. Consumer - comparison shopping

2. Career Profiles

Week 1 - Data Processing

Job Descriptions

-Machine Operator: translates written programs and other data into codes that can be machine-read.
-Tape librarian: maintains a library of magnetic tapes, punched cards, paper tapes, discs.
-Programmer: writes programs to solve problems in a language appropriate to the problem and the computer.
-Systems Analyst: responsible for overseeing all operations for completing a project.

Training

High school courses in computers, if possible
Two year technical programs for some entry level and technical positions
College degree and advance training for programmers, analysts and other positions.

Week 2 - Telephone and PBX Technician

Job Description

-Install and remove telephones
-Fill requests for services and equipment
-Locate faulty equipment and make repairs
-Set up radio and television equipment for "on the scene" broadcast

Training

High school or technical school gradates
Courses in math and electricity recommended
On-the-job training with some on-going training

Week 3 - Accounting

Job Descriptions

-Bookkeeper: keeps records, prepares payroll, prepares customers' statements of account
-Accountant: advises management about business procedures
-Auditor: verifies accounting records for legal acceptability

Training

High school graduate
Two or four year degree in accounting
Some specialized training for specific types of accountants

Week 4 - Air-conditioning, refrigeration and Heating Service Engineer

Job Description

-Install new equipment
-Repair or replace faulty parts, on-site or at repair shop
-Service equipment during off-season
-Test equipment and keep in prime running order

Training

High school graduates with courses in math, physics, electricity and blueprint reading
Apprenticeships with on-the-job training & courses at technical institutes

Week 5 - Graphic Arts

Job Descriptions

-Printing technician: operates and services printing machines; uses electronic computers in production
-Production specialist: coordinates materials and equipment needed for printing, scheduling for printing, handles production problems
-Technical services specialist: test materials, determines quality standards for each job, stays current with recent developments, keeps accurate records for continued improvement in production

Training

Some training may be available in high school
At least a community or junior college program should be completed

Week 6 - Electronic Computer Operator

Job Descriptions

-Prepare data so it is ready for the computer
-Operate computer consoles
-Operate auxiliary equipment to record results of computer operation
-Locate and correct difficulties

Training

High school graduates
Specialized training desirable
Previous work experience helpful
On-the-job training

Week 7 - Real Estate

Job Descriptions

-Real estate agents: computes asking price for property based on size, location, appearance, age
-Salesperson and broker: records listings of properties for sale, rental or lease
-Appraiser: inspects property to determine market value
-Mortgage and loan officer: prepares mortgages, makes title searches for purchase of property

Training

High school graduate preferred
Courses leading to special licenses
Some banks train their own employees
Two and four year college program available

Week 8 - Food Processing Technician

Job Description

-Help food scientists make better and new food products
-Test raw materials and finished products
-Supervise processing of food products
-Control sanitary conditions
-Inspect food sources for cleanliness and quality

Training

High school graduates with courses in biology, chemistry and math
Technical training recommended
Some on-the-job training

Week 9 - Distribution

Job Descriptions

-Stock clerk: sorts, stores and keeps track of merchandise
-Sales personnel: sells merchandise by promoting products
-Buyer: selects merchandise to be sold, keeps records of what is on hand
-Promotion: prepares advertising materials, arranges goods for sale to attract customers

Week 10 - X-ray Technician

Job Description

-Operate x-ray equipment in medical facilities
-Administer prescribed doses of radiation to patients
-Operate equipment for tracing and measuring radioactive materials in a patients body

Training

High school graduates with courses in math, physics, chemistry, biology and typing
Two year programs at technical school, hospitals or medical schools

Week 11 - Transportation

Job Descriptions

-Rate clerk: prepares rate statements, audits freight bills
-Traffic representative: sells freight business, settles complaints
-Traffic manager: manages all activities regarding freight and shipment of goods, knowledge of state and federal regulations
-Terminal manager: supervises loading, unloading, storing and crating of goods

Training

High school graduates for entry-level jobs
Special training for licenses and certificates
Two year college programs available

Week 12 - Photographic Lab Technician

Job Description

-Develop film
-Make photographs
-Enlarge or reduce photographs
-Set up lights and cameras and assists photographer

Training

High school graduates with courses in math, physics and chemistry preferred
Trade courses in photography
Apprenticeships with on-the-job training

Week 13 - Textiles

Job Descriptions

-General laboratory technicain: tests cloth samples for strength and weakness, determines characteristics of fibers
-Evenness tester technician: operates testing equipment and analyzes results, maintains quality control
-Production control technician: gathers data and makes calculations to keep materials moving through production
-Job study technician: time and motion studies, sets job loads, determines piece rates for different operations

Training

High school graduates for entry level jobs
Two and four year college programs
Advanced training (technical) recommended

Week 14 - Diesel Mechanic

Job Descriptions

-Repair heavy trucks
-Preventive maintenance to assure safe operation of trucks
-Specialized area mechanics

Training

High school graduates with some machine shop and automobile repair preferred, and with courses in math and science
Apprenticeship through firms
Technical or trade school courses

Week 15 - Home Furnishings

Job Descriptions

-Home planner: offers decorating services for retail purchasers and clients in homes
-Consultant: provides customers with advice on one phase of decorating -floor coverings, draperies, upholstery, furniture, lighting fixtures
-Display specialist: plans promotion of merchanidse for displays in stores
-Buyer: specializes in a particular department of a store and purchases merchandise for the department, trains salespeople

Training

High school graduate with distributive education background preferred
Two year programs available
Four year college programs in design

Week 16 - Waste water Treatment Plant Operator

Job Description

-Supervise equipment which removes waste from sewage water
-Test and correct levels of chemicals that remove germs from water
-Operate valves and pumps to keep water moving through treatment process
-Read meters and record date on log sheets
-Make minor repairs on equipment

Training

High school graduates with experience with machines and courses in math, chemistry, mechanics and earth science
State run programs
Apprentice programs with classroom and on-the-job training

Week 17 - Insurance

Job Descriptions

-Actuary: gathers and interprets information about people, makes predictions for long-term financial planning using mathematical formulas
-Insurance agent: convince public of security of insurance coverage (sometimes long and unusual hours)
-Investment counselor: invests premium money so funds available for beneficiaries, investigates sources of investments such as real estate, bonds, stocks and business ventures
-Claims adjustor: examines proof of loss, determines amount of settlements

Training

High school graduates for clerical posts
Two and four year college programs for training in business administration mathematics

Week 18 - Food Production

Job Descriptions

-Service and supply technician: produces and sells products used in food production (seed, fertilizer, pesticides, machinery, fuels), assists in research to develop new products and techniques
-Crop production technician: test soil, machinery and techniques for efficiency
-Farm owner or operator: uses talents of technician, manager and foreman to operate farm
-Processor and distributor: tests, grades, packages and transports food produced

Training

High school graduates for canneries, freezing and packing plants, farms
Two and four year college programs in agriculture recommended for higher level opportunities

Week 19 - Auto Technology

Job Descriptions

-Utility technician: compares fuels, determines knock characteristics of fuels
-Service manager: organizes and manages auto service department, assists in diagnosing automotive problems
-High performance engine technician: designs, tests, analyzes and maintains engines
-Engine test cell technician: prepares gas turbines and jet engines, installs test instruments to record information

Training
High school graduate with automotive mechanics course preferred
Graduates of technical programs desirable
Two and four year college and technical institute programs suggested

Week 20 - Food Services

Job Descriptions
-Restaurant manager: deals with staff to maintain quality and efficiency in service
-Flight kitchen manager: supervises airline food service, schedules employees and delivery of food and supplies
-Kitchen supervisor: coordinates kitchen and stores, purchases food and supplies, recommends menu to management

Training
Often on-the-job training
Vocational and technical schools have one and two year programs
Four year college food service administration programs available

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VII. "Multiplying Options and Subtracting Bias"

"'Multiplying Options and Subtracting Bias' is a set of four videotapes and a workshop guide with supporting materials designed to provide accurate information about women and mathematics and to change behavior in relation to the usefulness of math, stereotyping math as a male domain, confidence in learning math, stereotypic attitudes and differential treatment of females and males as learners of math. Each videotape and workshop is directed toward a different audience: teachers, counselors, parents and high school students."[19] This series of videotapes has been developed by Dr. Elizabeth Fennema of the University of Wisconsin-Madison.

Having previewed the student version of the tapes, I feel that this would be a valuable tool to use in our district, ultimately with all four of the audience groups. The student version included statistics regarding the number of women in traditionally male dominated career fields. Interviews of boys and girls showed various views of math and women in math. Various social pressures affecting girls' views of math are discussed. Finally a practical list of things for girls to do if they are experiencing math anxiety is given. I found the tapes visually pleasing and well organized. They are narrated by Marlo Thomas.

I have not had access, as yet, to the workshop guide and supplementary materials. I do not feel, therefore, that I am prepared to make definite plans for the use of these videotapes. I would like to organize some type of awareness for the parents of district students, since, as previously cited, parent attitudes and expectations are important in student attitudes and course selections. I would also like to arrange some type of viewing/workshop for 8th grade students before they begin planning their high school programs. On-going work in these directions will continue throughout the 1980-81 academic year.

VIII. Footnotes

1. Shelley Smolkin, "Fear of Figuring", Working Woman, (January, 1979), p. 54
2. Bonnie Donady and Sheila Tobias, "Math Anxiety", Teacher, (November, 1977), p,7
3. Lucy Sells, "The Mathematics Filter and the Education of Women and Minorities", ERIC Document, ED 121663, (February, 1976), p. 2
4. Sheila Tobias, "Why Jane Can't - Or Won't - Do Math" Independent School Bulletin, (May, 1978), p. 42
5. Jane Armstrong, "Women in Mathematics", (Denver: Education Commission of the States, March, 1980), p. 1
6. Sheila Tobias, "Math Anxiety: Why is a Smart Girl Like You Counting on Your Fingers?" Ms, (September, 1976) p. 57
7. Sheila Tobias, "Who's Afraid of Math and Why?", Atlantic Monthly, (September 1978) p. 64
8. Lewis Aiken, "Update on Attitudes and Other Affective Variables in Learning Mathematics", Review of Educational Research, (Spring, 1976), p. 295
9. Gail Thomas McLure and John McLure, Women's Studies, (Washington, D.C.: National Education Association, 1977), p. 43
10. Cliff Helling, "CD/HD = 1", School Science and Mathematics, (April, 1976) p. 31
11. Lucy Sells, "High School Mathematics Enrollments", draft for Science, (December, 1978)
12. Lynn Fox, "The Effects of Sex Role Socialization on Mathematics Participation and Achievement", ERIC Document ED142867, (December, 1976), p. 19
13. Armstrong, p. ix
14. Stanley Kogelman et al., "Mind Over Math: Overcoming Math Anxiety at the Dalton School", Independent School Bulletin, (May, 1978), p. 45
15. Fox, "The Effects of Sex-Role Socialization....", p. 82
16. Edith Luchins, "Sex Differences in Math: How Not to Deal With Them", American Mathematical Monthly, (March, 1979), p. 164
17. Abstract for Math Anxiety/Avoidance Prevention Project, Milwaukee Public Schools, Division of Curriculum and Instruction, Department of Elementary and Secondary Education, (November, 1979)
18. Tobias, "Math Anxiety: Why Is a Smart Girl....", p. 92
19. Elizabeth Fennema et al., "Mathematical/Science Intervention Strategies for Female Students in Elementary and Secondary Schools", (April, 1979), p. 1

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